ELECTRONIC INNOVATIONS IN ACTION

TUBES

—PRODUCT INFORMATION—

Beam Triode

6MA6

FOR HV SHUNT REGULATOR APPLICATIONS

■ COLOR TV TYPE ■ 30000 VOLTS DC ■ 40 WATTS PLATE DISSIPATION ■ X-RADIATION RATING

The 6MA6 is a low current, high-voltage, beam triode intended for use as a shunt regulator in the high-voltage power supply of color television receivers.

The 6MA6 has a maximum d-c plate-voltage rating of 30,000 volts, a maximum d-c plate current rating of 1.5 milliamperes, and a maximum plate-dissipation rating of 40 watts.

Features of the 6MA6 include built-in X-radiation shielding and additional design and specification controls for the reduction of X-radiation output to low levels even under conditions of equipment misadjustment and/or circuit failure mode operation.

GENERAL

ELECTRICAL

Cathode - Coated Unipotential

Heater Characteristics and Ratings

Heater Voltage, AC or DC ★	6.3 ± 0.6	Volts
Heater Current ●	0.2	Amperes
Direct Interelectrode Capacitances, approximate ▲		
Grid to Plate: (g to p)	0.03	pf
Input: g to (h+k)	2.4	pf
Output: p to (h+k)	0.88	pf

MECHANICAL

Operating Position - Any
Envelope - T-12, Glass
Base - B8-118, Short Medium Shell Octal 8-Pin
Top Cap - C1-50, Small
Outline Drawing - EIA 12-21

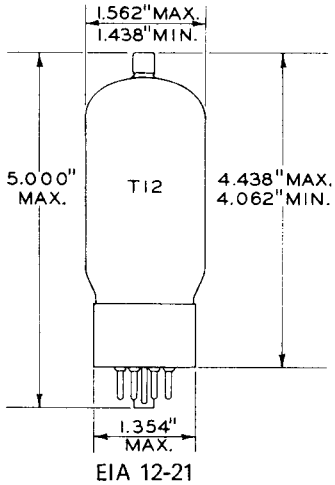
Maximum Diameter	1.562	Inches
Minimum Bulb Diameter	1.438	Inches
Maximum Over-all Length	5.000	Inches
Maximum Seated Height	4.438	Inches
Minimum Seated Height	4.062	Inches

MAXIMUM RATINGS

DESIGN-MAXIMUM VALUES UNLESS OTHERWISE INDICATED

Plate Voltage (Absolute-Maximum Value)	30000	Volts
Negative DC Grid Voltage	135	Volts
Peak Negative Grid Voltage §	440	Volts
Plate Dissipation (Absolute-Maximum Value)	40	Watts
DC Plate Current (Absolute-Maximum Value)	1.5	Milliamperes
Heater-Cathode Voltage		
Heater Positive with Respect to Cathode	Not Recommended	
Heater Negative with Respect to Cathode ⊕	450	Volts
Grid-Circuit Resistance □	3.0	Megohms
Bulb Temperature at Hottest Point †	240	°C

PHYSICAL DIMENSIONS

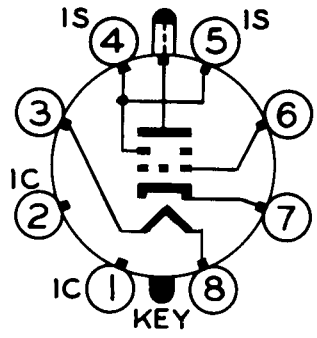


EIA 12-21

TERMINAL CONNECTIONS

Pin 1 - Internal Connection - Do Not Use
Pin 2 - Internal Connection - Do Not Use
Pin 3 - Heater
Pin 4 - Internal Shield ♦
Pin 5 - Internal Shield
Pin 6 - Grid
Pin 7 - Cathode
Pin 8 - Heater
Cap - Plate

BASING DIAGRAM



EIA 8NP

GENERAL ELECTRIC

MAXIMUM RATINGS (Cont'd)

Design-Maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making allowance for the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration.

The equipment manufacturer should design so that initially and throughout life no design-maximum value for the intended service is exceeded with a bogey tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all other electron devices in the equipment.

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

Unregulated DC Supply Voltage	36000	Volts
Equivalent Resistance of Unregulated Supply	11	Megohms
DC Reference Voltage	200	Volts
Equivalent Resistance of Reference Supply	1000	Ohms
Effective Grid-Plate Transconductance	200	Micromhos
DC Plate Current for Zero Load Current	1000	Microamperes
DC Plate Current for Load Current of 1 Milliampere	45	Microamperes
Regulated DC Output Voltage at Zero Load Current	25000	Volts
Regulated DC Output Voltage at Load Current of 1 Milliampere	24500	Volts

X-RADIATION RATING

	Maximum Plate Voltage	Maximum DC Plate Current	Maximum X-Radiation Output
X-radiation, maximum	27 KV	1.5 mA	0.5 mR/hr
	30 KV	1.3 mA	0.5 mR/hr

Based on accumulated sample test data taken initially and during life test, tubes do not exceed the maximum rating limit of 0.5 mR/hr at any time throughout their useful life when operated within the maximum ratings, including heater voltage, specified on this data sheet.

This X-radiation maximum rating is based on the use of the Victoreen 440 RF/C survey meter as the standard instrument for X-radiation measurement. X-radiation is measured with the plastic spacer of the 440 RF/C survey meter at a distance of four (4) inches from the external surface of the tube under test. This rating information is not necessarily applicable when a different radiation measuring instrument is used.

Sustained operation of the 6MA6 outside of the Absolute-Maximum Values indicated may damage the tube and/or result in either temporary or permanent changes in the X-radiation characteristics of the tube. Equipment design must be such that these Absolute Maximum Ratings are not exceeded over the worst probable range of adjustments and operating conditions for the set.

The X-radiation characteristics are measured in accordance with JEDEC Publication No. 67A, "Recommended Practice for Measurement of X-Radiation from Receiving Tubes," and controlled in accordance with JEDEC Publication No. 73A, "Recommended Practice for Quality Control of X-Radiation from High Voltage Rectifier and Shunt Regulator Receiving Tubes."

The General Electric Company makes no representation concerning the X-radiation output from these tubes when operated beyond the maximum ratings set forth herein, except as noted under "X-Radiation Characteristics."

X-RADIATION CHARACTERISTICS

EQUIPMENT MISADJUSTMENT AND/OR CIRCUIT FAILURE MODE OPERATION

The 6MA6 will produce varying levels of X-radiation depending upon operating conditions. Based on known attenuation factors of the tube construction materials and accumulated sample test data taken initially and during life test, X-radiation is not expected to exceed 0.5 mR/hr under equipment misadjustment and/or circuit failure mode operation of plate voltage and current listed below.

Maximum Plate Voltage	Maximum DC Plate Current	Maximum Expected X-Radiation Output
35 KV	0.1 mA	0.5 mR/hr
34 KV	0.3 mA	0.5 mR/hr
29 KV	1.5 mA	0.5 mR/hr

WARNING

X-RADIATION

Operation of the 6MA6 above the Maximum conditions shown for equipment misadjustment and/or circuit failure mode operation conditions may produce soft X-rays above 0.5 milliroentgens per hour which may constitute a health hazard on prolonged exposure at close range unless the tube is adequately shielded. Equipment design must provide required shielding.

Precautions must be exercised during the servicing of equipment employing the 6MA6 to assure that the high voltage is adjusted to the recommended value and that any shielding components are replaced to their intended positions before the equipment is operated.

SHOCK HAZARD

The high voltages at which the 6MA6 is operated can be extremely dangerous to the user or serviceman. Extreme care should be taken in the use of and in the servicing and adjustment of any high voltage circuit.

Precautions must be exercised during the replacement or servicing of the 6MA6 in equipment to assure that the high voltage output terminal is properly grounded while inserting or removing the tube from its socket or while connecting or disconnecting the top cap connector.

THE EQUIPMENT MANUFACTURER SHOULD PROVIDE A WARNING LABEL IN AN APPROPRIATE POSITION ON THE EQUIPMENT TO ADVISE THE SERVICEMAN OF ALL PRECAUTIONS HEREIN.

NOTES

★ The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.

● Heater current of a bogey tube at Ef = 6.3 volts.

▲ Without external shield.

♦ Shield should be connected directly to ground to minimize the effects of a momentary arc within the tube.

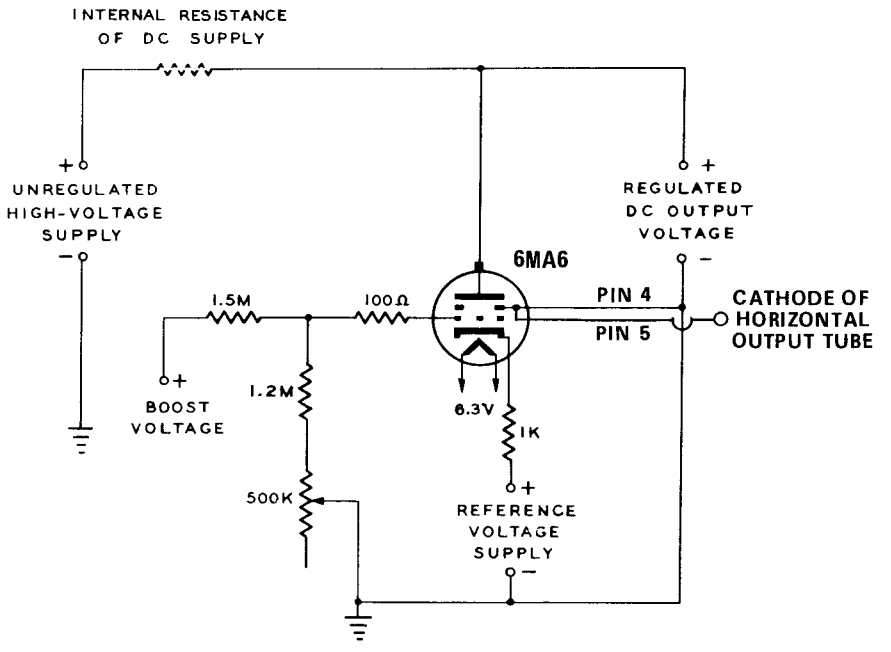
§ Peak value for duration of 20 seconds maximum during equipment warmup.

⊕ Sufficient impedance (1000 ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

□ With flyback transformer high voltage supply.

† Measured with an infrared thermometer, Ircon Model 700 BC or equivalent, at an ambient temperature of 40° C.

TYPICAL SHUNT REGULATOR CIRCUIT



APPLICATION CONSIDERATIONS

The base pins of the 6MA6 fit the standard octal socket. Socket terminals for pins 1 and 2 should not be used for tie points. Tube performance may be adversely affected should this precaution not be followed. It is permissible to tie the cathode of the horizontal output tube to pin 5 of the 6MA6 for circuit connection to ground.

Sufficient impedance (1000 ohms is suggested) should be in series with the cathode to limit the cathode current under prolonged heater-cathode short-circuit conditions to 450 ma. This protective impedance will minimize the danger of heater burnout in case of a momentary heater-cathode arc within the tube.

The high voltages at which the 6MA6 is operated may be very hazardous. Extreme caution should be used while making any circuit adjustments. The 6MA6 and all of its associated hardware should be housed in a protective enclosure. It is particularly important that all parts which may be at a high potential with respect to ground be housed in this protective enclosure. The protective enclosure should be constructed with a system of interlocks to prevent anyone from coming in contact with any high potential point in the electrical system. The interlocks should break the primary circuit of the high-voltage supply when any part of the protective enclosure is open, and should prevent the closing of the primary circuit until the protective enclosure is closed and locked.

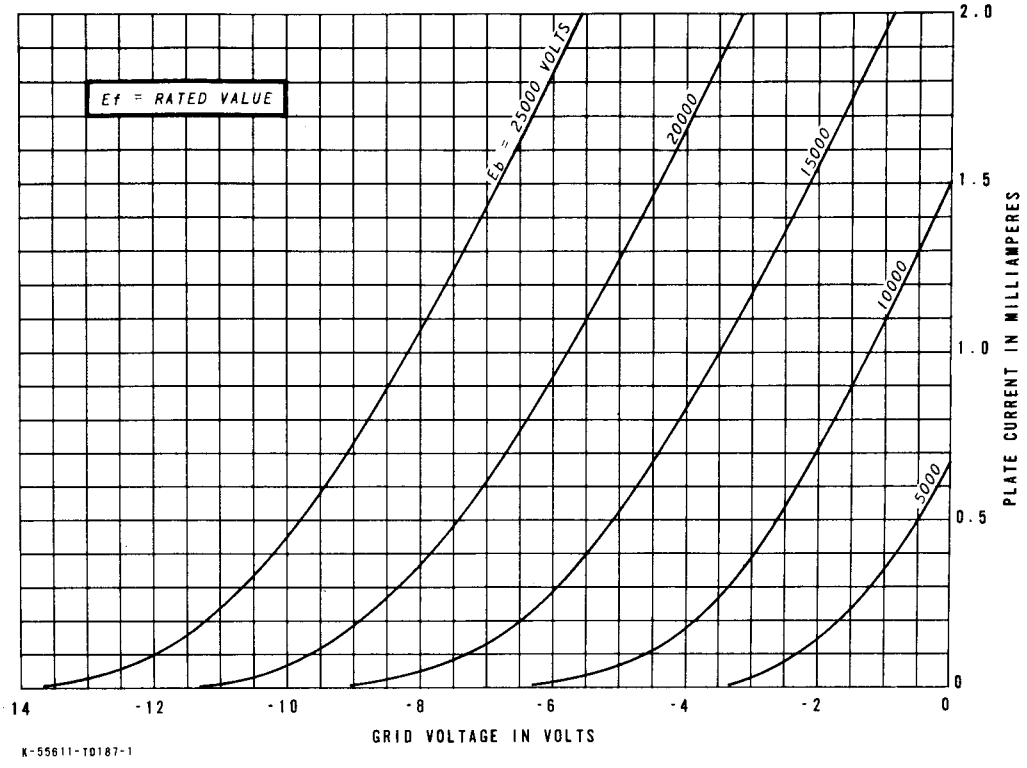
High voltages may appear at points in the circuit which are normally at low potentials as a result of improper circuit connection or of capacitor breakdown. Therefore, before touching any part of the circuit, the power supply switch should be turned off and both terminals of any capacitor be grounded.

The bulb of the 6MA6 becomes hot during operation. Therefore, it is essential that provision be made for free circulation of air around the tube in order to insure sufficient cooling.

The plate of the 6MA6 exhibits a dull red color when the tube is operated at maximum plate dissipation. In addition, it may exhibit a bluish glow on the upper half of the bulb inner wall surface during normal operation. This bluish glow is a result of fluorescence and it should not be mistaken for gas.

To prevent any strain from being exerted on the seal of the plate cap, it is important that connection to the plate cap be made by an appropriate connector which has a flexible lead.

AVERAGE TRANSFER CHARACTERISTICS



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